



**TECHNICAL REPORT
NATICK/TR-01/012**

AD _____

**EVALUATION OF ENHANCED RATION,
GENERAL ISSUE (ENRGI), DURING COMBAT TRAINING
EXERCISES AT FT. POLK, LA SEPTEMBER 2000**

by
**Brian Hill
Matthew Kramer
Alan LaBrode
and
Joseph Zanchi**

June 2001

Final Report
August 1999 - October 2000

Approved for Public Release; Distribution is Unlimited

20030508 138

**U.S. Army Soldier and Biological Chemical Command
Soldier Systems Center
Natick, Massachusetts 01760-5020**

DISCLAIMERS

The findings contained in this report are not to be construed as an official Department of the Army position unless so designated by other authorized documents.

Citation of trade names in this report does not constitute an official endorsement or approval of the use of such items.

DESTRUCTION NOTICE

For Classified Documents:

Follow the procedures in DoD 5200.22-M, Industrial Security Manual, Section II-19 or DoD 5200.1-R, Information Security Program Regulation, Chapter IX.

For Unclassified/Limited Distribution Documents:

Destroy by any method that prevents disclosure of contents or reconstruction of the document.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

The public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, to Department of Justice, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.

1. REPORT DATE (DD-MM-YYYY) 06/01/01		2. REPORT TYPE Final		3. DATES COVERED (From - To) August 99 thru October 00	
4. TITLE AND SUBTITLE EVALUATION OF ENHANCED RATION, GENERAL ISSUE (ENRGI) DURING COMBAT TRAINING EXERCISES AT FT. POLK LA SEPTEMBER 2000				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S) Brian Hill, Matthew Kramer, Alan LaBrode, and Joseph Zanchi				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER D 610 643747	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) U.S. Army Soldier and Biological Command (SBCCOM) Soldier Systems Center ATTN: AMSSB-RCF-I (N) Kansas Street, Natick MA 017760-5018				8. PERFORMING ORGANIZATION REPORT NUMBER NATICK/TR-01/012	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for Public Release; Distribution Unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT At the request of TRADOC System Manager - Soldier during the Joint Service Operational Rations Forum in Feb 00, Soldier Systems Center Combat Feeding Program (CFP) directed efforts to design an enhanced ration pack that addresses the concerns for a lighter weight, low-volume energy-rich food source. Using the recently developed shelf stable pocket sandwich as the prime component, CFP personnel developed a conceptual modular sustainment ration, named Enhanced Ration, General Issue (ENRGI) that is packaged and complemented with highly acceptable, energy-rich eat-on-the-move components to provide a well-balanced, nutritious ration designed for use during the first 24-96 hours of intense combat activities. Approximately 625 ENRGI rations were produced and assembled in-house and subsequently provided to Land Warrior (LW) Platoon soldiers operating as a component of the JFC-AWE that took place at Ft. Polk, LA in Sep 00. The objective was to provide support to Joint Contingency Force - Advanced Warfighting Experiment (JFC-AWE) by providing two conceptual meals a day for 10 days to 39 LW soldiers and obtain feedback for future modular sustainment ration initiatives in the CFP.					
15. SUBJECT TERMS COMBAT RATIONS DISMOUNTED SOLDIER PERFORMANCE ENHANCEMENT BATTLEFIELD RATIONS FIELD FEEDING HIGH MOBILITY PREPARATION TIME PROTOTYPE MEALS LIGHTWEIGHT STREAMLINE SPECIAL PURPOSE NUTRITION					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			Brian Hill
U	U	U	U	25	19b. TELEPHONE NUMBER (Include area code) (508) 233-4501

TABLE OF CONTENTS

LIST OF FIGURES	iv
LIST OF TABLES	iv
PREFACE	v
1 - EXECUTIVE SUMMARY	1
2 - INTRODUCTION	2
Analysis & Requirement Determination	2
Strategic Link to Army Vision	2
Future Army Tactical Perspective	4
Development of the Conceptual ENRGI Ration	5
3 - SUPPORT TO JCF - ADVANCED WARFIGHTER EXPERIMENT	6
Request from TSM Soldier for Support	6
Pre and Post-Test Preparation	6
Plan of Action	6
ENRGI Ration Menus Provided to AWE	7
4 -- FEEDBACK FROM AWE EXERCISE	8
Focus Groups on ENRGI Concept Ration	8
Ration Use	8
Discussion of Soldier Surveys	8
Reactions to Ration Components/M Meal Concepts	8
Reactions to Ration Packaging	9
5 - RECOMMENDATIONS	9
Discussion of Future First Strike Ration Development Efforts	9
Link to Future Corollary Development Efforts within Combat Feeding Program	10
Appendices	13
A. OBJECTIVE FORCE DESIGN	13
B. PROPOSED REVISED CONCEPT FOR WARTIME FEEDING	15
ACRONYMS	17

LIST OF FIGURES

Figure	Page
1. Determination of Special Purpose Ration Requirements	2
2. Army Vision Strategic Elements	2
3. Army Transformation Path to the Objective Force	3
4. Spectrum of Military Operations as Described in the Army Vision	4
5. Conceptual ENRGI Menus	5
6. Basic Menu Components	6
7. Innovative CHO Packaging Design	9

LIST OF TABLES

Table	Page
1. ENRGI Menus	7

PREFACE

This document records work performed by U.S. Army Soldier and Biological Chemical Command (SBCCOM), Soldier Systems Center, Natick personnel during the period August 99 thru October 00. It pertains to the design and subsequent development and evaluation of a conceptual special platform assault ration called ENRGI. This new modular special purpose ration concept was evaluated by Land Warrior Platoon soldiers operating as a component of the Joint Contingency Force – Advanced Warfighting Experiment (JCF-AWE) at Ft. Polk, LA during September 00.

The authors would like to acknowledge the following members of the Combat Feeding Program for their technical expertise and timely support:

Individual Combat Ration Team (ICRT)

Julie Edwards
Daniel Nattress
Peter Sherman

Performance Enhancement & Food Safety Team (PEFST)

Jack Briggs
Betty Davis
Claire Lee
Jacqueline LeBlanc
Paul Maguire
Ken Racicot

Advanced Processes and Packaging Team (APPT)

Michelle Richardson

Group Ration Team (GRT)

Jay Jones

EVALUATION OF THE ENHANCED RATION, GENERAL ISSUE (ENRGI) DURING COMBAT TRAINING EXERCISES at POLK, LA SEPTEMBER 2000

1 - EXECUTIVE SUMMARY

There exists a need for a new ration concept that supports and enables full and rapid implementation of the Army's Vision for the Future including the Interim Brigade Concept Team, Legacy Force transformation and standup of the Objective Force for a more responsive, deployable, agile, versatile, lethal, survivable, and sustainable military. The spectrum of likely operations describes a need for land forces in joint, combined, and multinational formations for a variety of missions extending from small scale contingency operations in complex and urban terrain, confronting low-end and mid-range threats, stability and security operations, and in major theater war. The new ration concept will also support tailored application to "Land Warrior" requirements for specific infantry units. This new ration concept will not replace the MRE but will augment the MRE capabilities and provide a flexible ration option in support of the Future Combat System.

At the request of TRADOC System Manager - Soldier (TSM-Soldier) during the Joint Service Operational Ration Forum (JSORF) in Feb 00, the Natick Soldier Center's Combat Feeding Program (CFP) directed efforts to design an enhanced ration pack that addresses their concerns for a lighter weight, low-volume, modular, and energy-rich food source. Using the recently developed shelf stable pocket sandwich as the prime component, CFP personnel developed a conceptual ration, named Enhanced Ration, General Issue (ENRGI), designed as a preliminary "First Strike" ration that addresses the aforementioned concerns. The pocket sandwich is complemented with highly acceptable, energy-rich components such as pound cake, fudge brownies, ERGO™ carbohydrate/ electrolyte beverage, fortified HooAH!® Bar and fortified, carbohydrate-modified applesauce, as well as other associated compatible eat-on-the-move components to provide a well-balanced, nutritious, energy-rich ration. The conceptual ENRGI ration provides between 1000-1200 calories rich in carbohydrates and proteins.

Four varieties of eat-on-the-move, eat-out-of-hand pocket sandwiches were configured as four menus along with a separate carbohydrate energy supplement menu. Approximately 625 combined ENRGI rations were produced and assembled in-house and subsequently provided to Land Warrior (LW) Platoon (3/325) soldiers operating as a component of the JCF-AWE that took place at Ft. Polk, LA in September 2000. The objective was to provide support to Joint Contingency Force - Advanced Warfighting Experiment (JCF-AWE) by providing two conceptual meals a day for 10 days to 39 LW soldiers and obtain feedback for future First Strike Ration initiatives in the CFP. This special purpose ration concept was the first attempt to optimize those highly acceptable MRE components and new developmental items that are energy-rich in a lower weight and volume product for possibly use during the first 24-96 hours of combat. It will provide a flexible ration to align with new doctrinal, force mix and mission variables. It also serves as a baseline effort and configuration upon which to design, develop, and refine the emerging "First Strike" concept for the 21st century warrior.

Despite the limited experience each of these soldiers had with the concept ration pack, it was clear that the notion of a streamlined, easy to eat meal providing substantial energy with no accessory items is seen as having a role to play in deployment.

2 – INTRODUCTION

Analysis & Requirement Determination

Output from a previous military service requirement (MSR) entitled *Analysis to Determine Special Purpose Ration Requirements* pointed to the urgent need for a new ration concept that supports and enables full and rapid implementation of the Army's Vision for the Future as part of a Special Purpose Ration Platform. This concept dictates a requirement for a special situation ration that surpasses any existing ration in terms of weight/ cube/ soldier load, preparation time, performance enhancement, and high mobility. It must be a highly modular, performance sustaining/ enhancing, individual combat/assault ration designed to provide optimal levels of nutrition and enhanced mental acuity to dismounted infantry, rangers, and mounted wheel and track crew platform personnel while operating in the Interim Brigade Concept Team (IBCT) and future Full Spectrum, Heavy and Light Brigades. This requirement was further evident when, at the request of TSM-Soldier during the Joint Service Operational Rations Forum (JOSORF), the Combat Feeding Program was requested to design and provide lighter weight, low volume energy rich, modular ration meals for the Joint Contingency Force – Advanced Warfighting Experiment (JCF-AWE) that took place at Ft. Polk, LA in September 2000. Using the recently developed shelf stable pocket sandwich as the prime component, energy-rich components such as pound cake, carbohydrate/ electrolyte beverage, fortified HooAH!® Bar, fortified applesauce, as well as other compatible eat-on-the move components, four prototype Enhanced Ration, General Issue or ENRGI conceptual modular rations were rapidly developed and provided to Land Warrior (LW) platoon soldiers operating as a component of the JCF-AWE. The conceptual ENRGI, as designed, is about 50% the volume as well as 50% of the weight of the MRE, while providing almost 85% of the total calories. This volume and weight savings could be achieved because typical packaging and packing requirements were purposely disregarded in order to demonstrate potential savings as a result of packaging improvements/ redesign and optimization. This issue will be further discussed in the report and recommendations. The objective was to provide two conceptual meals a day for 10 days to 39 LW soldiers as part of the AWE exercise and obtain feedback to support future modular combat ration initiatives such as First Strike as well as other areas of immediate need. Direct soldier feedback will have a positive impact and user influence on the ultimate direction, design, configuration and component selection/ development of any near term ration and ration supplement systems developed or adopted for the Objective Force warrior.

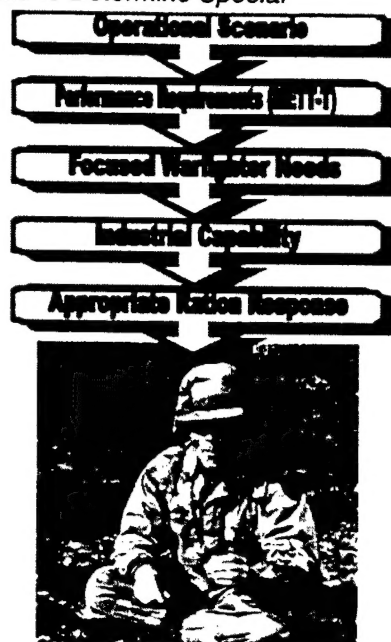


Figure 1. Determination of Special Purpose Ration Requirements

Strategic Link To Army Vision

In order to fully appreciate the sustainment concepts emerging and the underlying rationale it is imperative to review the doctrinal connection to the Army strategic vision. It is driven by the Future Security Environment, National Security Strategy and National Military Strategy, and the Pace and Proliferation of Technology. The Army is a strategic instrument of national policy. As such it must effect a comprehensive transformation to better meet current and future strategic requirements and challenges by transforming the Army into a force strategically responsive and dominant at every point on the spectrum of conflict. This is particularly relevant given the emergence of an increasingly complex international security environment, new and increased sources of conflict and tension, regional instability, religious and ethnic militarism, and criminal and terrorist elements which threaten U.S. interests.



Figure 2. Army Vision Strategic Elements.

These activities and events together with a proliferation of various technologies and weapons of mass destruction (WMD) present significant challenges to the U.S. and result in increased requirements for U.S. landpower to conduct full spectrum operations.

The new Army vision aims to meet these requirements by transforming the Army into a force strategically responsive and dominant at every point on the spectrum of conflict. This Objective Force will meet the challenges of the 21st century by providing a more responsive, deployable, agile, versatile, lethal, survivable, and sustainable Army. This force must be capable of reversing the conditions of human suffering rapidly and resolving conflicts decisively. The characteristics of the Objective Force are complementary features that together produce an overall capability and synergy greater than the individual capabilities they describe. This synergy will revolutionize the effectiveness of the Army in order to match its capabilities with the Nation's strategic requirements. Advances in information, materials, and weapons systems technologies will enable new organizational and operational concepts that optimize the employment of Army and joint capabilities across the full spectrum of operations for seamless transition from disaster relief to low-intensity contingencies to high-intensity warfighting without pause. The Army will maintain the decisive capabilities of today's warfighting organizations through recapitalization and fielding of new equipment to sustain overmatch of legacy forces, and will challenge the science and technology (S&T) community to develop solutions for the Objective Force.^{1,2}

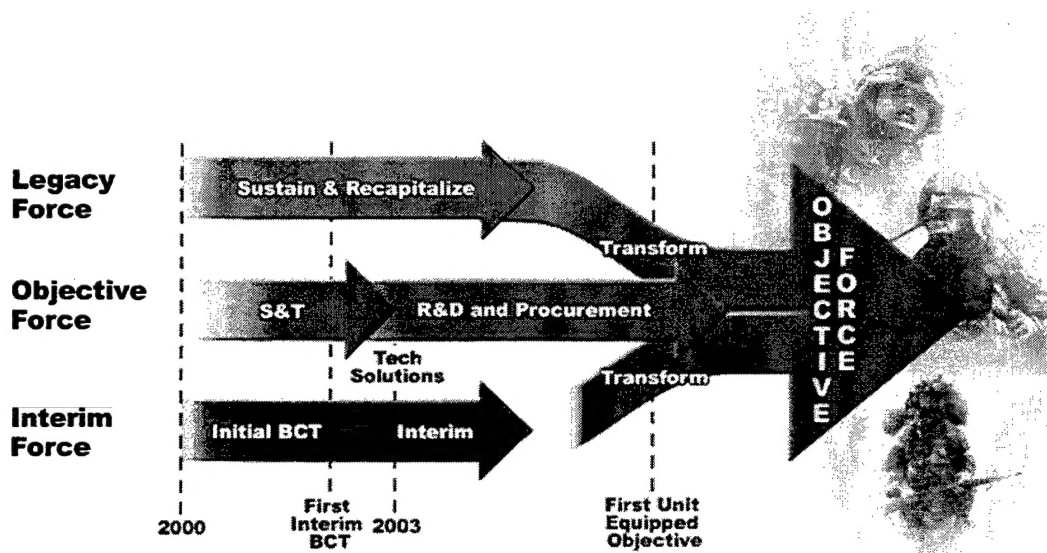


Figure 3. Army Transformation Path to the Objective Force.

In order to become more deployable and maintain lethality the Army will field a prototype brigade-size force. The intent is to establish brigades in the near term that will use off-the-shelf systems, as resources permit and as quickly as possible, to jumpstart development of concepts and doctrine, organizational design, and training.

The Army will improve responsiveness by reducing numbers and types of systems it deploys as technology permits using communications and information technology to enable "split base" operations and "reach back" to reduce the footprint of deployed forces. This transformation pioneers an organization that reduces demands for replenishment supplies while stationing its forces and material in strategic locations to enable rapid power projection. The core competency of the Army remains warfighting and the Army Vision emphasizes the need for agile formations, which include the current division structure, as well as new versatile, lethal organizations which are more flexible, responsive and survivable. In order to

Reference ¹: *The United States Army Posture Statement, FY01*

²: *Army Vision Brief, October, 2000.*

accomplish its goals, the Army must also reduce its logistical footprint. This requires developing a systems approach to fielding platforms as well as a revolutionizing the way the Army transports and sustains the force.

Future Army Tactical Perspective

The Army Vision's goal is to ensure responsibilities in continuously meeting the National Military Strategy are fulfilled. To do this will require the Army to transform itself into a full spectrum force capable of dominating at *any* point on the spectrum of operations. It is clear the Objective Force is not the end of the campaign, but only the end of the beginning of an entirely new and evolutionary force modernization concept. The Force Characteristics interaction and synergy within the Objective Force design will enable domination at any point across the spectrum. It will further create a force capability for dominant maneuver, precision engagement, full dimensional protection and supported through focused logistics concepts reducing the overall logistics footprint. This is possible through the transformation process associated with the Objective Force design (Reference Appendix A). This design describes a required characteristic and appropriate tactical response. These key elements are interwoven to generate a synergy to ultimately achieve the Army Vision.

Supporting this force transformation there is a need for a new ration concept to enable full and rapid implementation of the Army's Vision for the interim, Initial and Objective Brigade. The spectrum of

operations describes a need for land forces in joint, combined, and multinational formations for a variety of missions extending from small scale contingency operations in complex and urban terrain, confronting low-end and mid-range threats, security operations, and in a major conflict. The new ration concept will also support tailored application to "Land Warrior" requirements for specific infantry units. As a full spectrum combat force, the Brigade maintains an offensive orientation in all operational environments against all projected future threats but is not limited to combat alone as missions may include stability and humanitarian assistance/disaster relief, and peacekeeping. The Brigade's core capabilities are operational and tactical mobility, situational understanding, combined arms integration (down to company level), and high dismount strengths for close combat in urban and complex terrain, including a wide range of environments and infrastructures, as well as civilian populations. The CSA Vision for the Army of the 21st Century requires the services to be more strategically responsive, agile, flexible, versatile, rapidly deployable, highly mobile, self-sustaining, survivable, and more lethal while operating on future battlefields. Land forces clearly must dominate at every point along the spectrum of operations.



Figure 4. Spectrum of Military Operations as Described in the Army Vision.
Reference Footnote 2

The Objective Force design establishes a goal for rapid "quick-strike" and decisive force projection; to deploy a combat capable brigade anywhere in the world within 96 hours after liftoff, a warfighting division on the ground within 120 hours, and five divisions within thirty days. This concept dictates a new military requirement for a special situation ration that surpasses any existing ration in terms of weight/ cube/ soldier load, preparation time, performance enhancement, and high mobility. This technology development will enable the Army to fully achieve the capability mandated in the Objective Force design and accomplish military objectives, missions, and tasks associated with the vision. This new first strike ration concept will provide the optimal fuel for the combatant during the intense period of initial 24-96 hours of engagement as an augment to current ration platforms (Reference Appendix B). New ration concepts must be a highly modular, performance sustaining /enhancing, individual combat/assault ration designed to provide optimal levels of nutrition and enhanced mental acuity to dismounted infantry, rangers and mounted wheel and track crew platform personnel while operating in the Interim Brigade Concept Team and future Full Spectrum, Heavy and Light Brigades.

Development of the Conceptual ENRGI Ration

The CFP has directed efforts to design an enhanced ration pack that addresses the concerns for a lighter weight, low volume energy rich food source. Using the recently developed shelf stable pocket sandwich as the prime component, additional highly acceptable energy-rich components such as pound cake, a carbohydrate/ electrolyte beverage, fortified HooAH!® Bar and fortified, carbohydrate-modified applesauce, as well as other associated compatible eat-on-the move items were included in the basic product design. The menu design and configuration consists of four packets of different variety "eat-out-of-hand" sandwiches and associated components along with a separate fifth menu as a carbohydrate (CHO) energy supplement. Each was developed, produced, and assembled in-house.



Figure 5. Conceptual ENRGI Menus.
Left – Basic Menu.
Right – CHO Supplement Pack.

As we know, soldiers often field strip the MRE to select only what they consider to be the most essential items. This test concept will be one of the first clear indicators as to a soldiers' general attitude towards a future First Strike Ration (more limited than the MRE) designed for the initial 24-96 hours of operation.

This special purpose ration concept was the first attempt to optimize those highly acceptable MRE components that are energy-rich in a lower weight and volume product for the first 24-96 hours of combat. The Combat Feeding Program estimates that the weight savings per ENRGI meal, as currently designed, will save over a half pound and have about half the volume versus the current MRE. Of course the ENRGI meal has less calories and nutritional capabilities than the MRE, which is still the ration of choice given extended operations.

This packet will provide, depending on the components, between 1000-1200 kilocalories (kcal). Essentially, the energy will be delivered from a component mix that approximates 70% carbohydrate, 15% fat, and 15% from protein for essential amino acids. Carbohydrate is the most efficient fuel. The first source of glucose for the exercising muscle is its own glycogen source. Exhaustion is correlated with the depletion of glycogen stores and the consequent failure to provide enough blood glucose for the exercising muscle. To allow maximum repletion of glycogen, most soldiers should consume a diet in which 60-70% of the calories is derived from carbohydrate. The fortified HooAH!® Bar (contains vitamins that are believed to be essential for bone growth such as Vitamins D, C, and K, provides 100% of Folate), also contains 50% of the recommended consumption of essential amino acids in one bar. A continuous supply of amino acids is required to replace the losses during exercise.

This new concept is envisioned to augment the MRE in preposition war reserves supporting a specific target audience for a defined window of opportunity and deployments. *It will not replace the MRE.* It will provide a tailorable, flexible ration to align with new doctrinal, force mix, and mission variables. It will utilize a variety of novel food processing, preservation and stabilization technologies and innovative packaging technologies to provide a lightweight, low volume, first generation early engagement "quick-

strike" ration targeted at the minimum threshold objective of 24-96 hours of sustained, high intensity combat action. ENRGI's will provide a "field stripped" performance oriented, high-mobility, nutritionally optimized, modular ration. It will require no heating or other field preparation as it will consist of primarily eat out of hand components for a true "eat-on-the-move" ration. The ENRGI concept and subsequent First Strike Ration will reduce the Army's logistics footprint and re-supply requirements.

3 -- SUPPORT TO JCF ADVANCED WARFIGHTER EXPERIMENT

Request from TSM Soldier for Support

TSM-Soldier requested support during the Joint Service Operational Rations Forum in Feb 00 to Land Warrior (LW) Platoon (3/325) soldiers operating as a component of the JCF-AWE that took place at Ft. Polk, LA in Sep 00. The Combat Feeding Program saw this as an opportunity to actively participate in the future Army Vision initiatives/exercises and devised a plan to provide the conceptual ENRGI ration in two meals a day for 10 days to 39 LW soldiers and obtain feedback for future modular sustainment ration initiatives.

Pre- and Post-Test Preparation

PRE-AWE: At the pre-visit, the participating unit was briefed on the items issued, why this was being done, and that this was an opportunity to provide feedback on an initial deployment ration concept that may differ from the standard MRE.

In addition, CFP used a combination of interviews/focus groups and written surveys to obtain soldier opinions on what they actually take/consume under these types of scenarios; soldiers' input and suggestions on tailoring this concept; what their specific ration needs are; and what soldiers consider the most crucial issues for rations of this type.

POST-AWE: As in the pre-visit, a combination of interviews and surveys were employed to obtain feedback on the prototype ration items. While issues such as general acceptability etc., were addressed, the main focus was how these rations met soldiers' needs, how the meal concepts could be improved/modified, and their suggested solutions for the ration under the conditions of the AWE.

Plan of Action

CFP targeted a production and delivery of four varieties (total of 500 sandwiches) ENRGI's and 125 CHO supplement packs to Ft Bragg to meet the time window to support the LW Platoon (3/325) as it prepared for and deployed to JRTC in Sep 00. This supported the platoon train-up and operations at JRTC. CFP offered instructional support (focus groups) at Fort Bragg during the time period between 14-16 Aug 00 and completed post JCF-AWE focus group sampling to determine level of product satisfaction, at Ft Polk, LA in 18-19 Sep 00 timeframe.

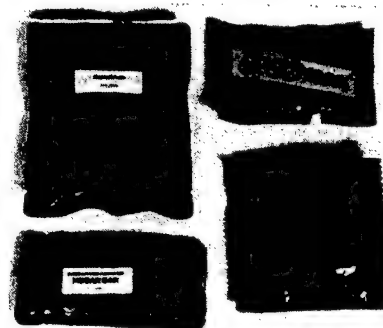


Figure 6. Basic Menu Components

ENRGI Ration Menus Provided to AWE

The concept menus were packed (125 each) (Total 625) in clear re-sealable pouches for the FTX. The packaging was not optimized for this early prototype configuration and will undoubtedly be a significant focus and thrust area in follow-on development work for the emerging First Strike platform. The current packaging design was merely intended as a demonstrator for evaluation purposes to obtain soldier feedback on concept, possible weight and volume sizing, configuration, overall utility, and features such as tear seal, reseal closure and labeling. Menus 1-4 (Table 1) contained approximately 1000 kcal apiece and consist of a pocket sandwich, a fortified HooAH!® Bar, an energy-rich glucose-optimized (ERGO) beverage, and dessert item. Average weight of the ENRGI menus 1-4 with packaging is approximately 316grams. Menu five is the CHO energy supplement pack consisting of a fortified, high protein HooAH!® Bar and a carbohydrate enriched applesauce (Zapplesauce) packaged in a pouch with a preformed spout for consumption.

Neither FRH's or other standard MRE meal accessories were provided. The ration was seen as and presented to these troops as something that would augment – not replace – the MRE for short duration restricted consumption focusing on macro-nutrients and not micro-nutrient content. It is intended to address the need for a lightweight, reduced volume but relatively high energy and easy to eat ration for initial deployment.

TABLE 1. ENRGI MENUS

MENU 1	MENU 2	MENU 3
RASPBERRY ERGO DRINK FORTIFIED CRAN/RASPBERRY HOOAH BAR BARBECUE CHICKEN POCKET SANDWICH MRE POUND CAKE (LEMON)	ORANGE ERGO DRINK FORTIFIED CRAN/RASPBERRY HOOAH BAR BARBECUE BEEF POCKET SANDWICH MRE OATMEAL COOKIE	TROPICAL ERGO DRINK FORTIFIED CRAN/RASPBERRY HOOAH BAR PB & J POCKET SANDWICH MRE SHORTBREAD COOKIES
CALORIES 1110 CALORIES FROM FAT 297	CALORIES 1060 CALORIES FROM FAT 260	CALORIES 1110 CALORIES FROM FAT 297
<div> <div>TOTAL FAT 33g</div> <div>SODIUM 1070 mg</div> <div>TOTAL CARBOHYDRATE 166g</div> <div>PROTEIN 34g</div> <div>VITAMIN A 4%</div> <div>CALCIUM 66%</div> </div> <div> <div>% DAILY VALUE</div> <div>21%</div> <div>15%</div> <div>38%</div> <div>VITAMIN C 280%</div> <div>IRON 97%</div> </div>	<div> <div>TOTAL FAT 29g</div> <div>SODIUM 1150 mg</div> <div>TOTAL CARBOHYDRATE 166g</div> <div>PROTEIN 34g</div> <div>VITAMIN A 0%</div> <div>CALCIUM 67%</div> </div> <div> <div>% DAILY VALUE</div> <div>18%</div> <div>16%</div> <div>37%</div> <div>VITAMIN C 286%</div> <div>IRON 104%</div> </div>	<div> <div>TOTAL FAT 33g</div> <div>SODIUM 710 mg</div> <div>TOTAL CARBOHYDRATE 159g</div> <div>PROTEIN 32g</div> <div>VITAMIN A 0%</div> <div>CALCIUM 64%</div> </div> <div> <div>% DAILY VALUE</div> <div>21%</div> <div>10%</div> <div>36%</div> <div>VITAMIN C 280%</div> <div>IRON 106%</div> </div>
MENU 4	MENU 5	
LEMON LIME ERGO DRINK FORTIFIED CRAN/RASPBERRY HOOAH BAR PEPPERONI STICK POCKET SANDWICH MRE FUDGE BROWNIES	ZAPPLESAUCE FORTIFIED CRAN/RASPBERRY HOOAH BAR	
CALORIES 1110 CALORIES FROM FAT 330	CALORIES 390 CALORIES FROM FAT 54	
<div> <div>TOTAL FAT 37g</div> <div>SODIUM 1060 mg</div> <div>TOTAL CARBOHYDRATE 160g</div> <div>PROTEIN 35g</div> <div>VITAMIN A 2%</div> <div>CALCIUM 64%</div> </div> <div> <div>% DAILY VALUE</div> <div>23%</div> <div>15%</div> <div>36%</div> <div>VITAMIN C 285%</div> <div>IRON 112%</div> </div>	<div> <div>TOTAL FAT 6g</div> <div>SODIUM 10 mg</div> <div>TOTAL CARBOHYDRATE 166g</div> <div>PROTEIN 14g</div> <div>VITAMIN A 0%</div> <div>CALCIUM 0%</div> </div> <div> <div>% DAILY VALUE</div> <div>4%</div> <div>0%</div> <div>22%</div> <div>VITAMIN C 200%</div> <div>IRON 82%</div> </div>	

4 – FEEDBACK FROM AWE EXERCISE

Focus Groups on ENRGI Concept Ration

The purpose of this first effort was to obtain soldiers' feedback on a conceptual ration pack for initial deployment. The soldiers providing feedback were members of the 3/325 Air Inf who participated as the LW platoon during an Advanced Warfighting Experiment (AWE) at JRTC during September of 2000. Prior to the deployment of the Unit the prototype rations were delivered and the Company's 1st SGT and S-3 were briefed on the purpose of the rations and intent of this assessment.

Following the training, the unit returned to Ft. Bragg and on 20 September provided feedback on the prototype ENRGI ration. Two focus groups were conducted with approximately eight soldiers apiece. In addition the 1st SGT of the unit provided verbal feedback to Natick representatives. The soldiers participating were in their early twenties with most being PFC's (E-3).

Ration Use

The soldiers reported that they were issued two ENRGI meals apiece at the start of the training at JRTC and were not subsequently issued any additional ENRGI meals. Thus any given soldier's exposure was limited and not all had one of the Zapplesauce/ HooAH![®] Bar meals. These soldiers reported eating – on average – two MRE's per day with no hot meals.

Discussion of Soldier Surveys

Despite the limited experience the soldiers had with the prototype ENRGI meals, it was clear that the notion of a modular/streamlined, easy-to-eat meal providing substantial energy with no accessories items was seen as having a substantial role in future deployments and fully supports the Army's Joint Vision 2020 initiatives.

Reactions to Ration Components/Meal Concepts

On the whole, the reactions to the concept of meals composed of pocket sandwiches, bars, beverage powder, and dessert items without accessory items or a heater were positive. The participants did not see this as a replacement for the MRE but a reasonable approach for initial deployment (one or two days) where the ability to eat items easily and on the go is attractive. For soldiers such as these, little personal food (or pokey bait) can be carried and conditions often do not permit heating.

Most of the soldiers felt that the idea of pocket sandwiches was a good one despite the fact that the actual sandwiches issued were not uniformly well liked. The pepperoni and barbeque sandwiches seem best received while a few noted that the peanut butter and jelly sandwiches, while popular, were considered to be dry. This issue has been identified and addressed through further sensory and analytical evaluation as well as in additional pilot runs and will be corrected in future product formulations and processing of this item. Some soldiers felt that items such as the sandwiches need to be bigger. Several soldiers made a point of saying that they like the ease and convenience associated with this ration concept even though they did not like many of the specific items. Many soldiers in both groups felt that the ENRGI meals were too small, particularly for more than a day or two, but did feel they could have a place in the overall ration scheme.

Similarly, items such as HooAH![®] Bars or commercial candies – even if not always liked – were seen as potential useful for periods when eating a regular meal or entrée is problematic. As a concept ration for initial deployment – especially if some MRE's were issued – these soldiers seemed to feel that the lack of accessories as well as the FRH was fine – particularly as it simplified their deployment preparation (less need, if any, for field stripping) and produced less waste.

Among the ration items suggested for future use by these soldiers were various types of commercial crackers (sandwich type) jerky, gels, breads with spreads (especially cheese). Many of these soldiers

were also interested in high protein and/or carbohydrate drinks and foods feeling that they provide needed energy and help in recovery from physical stress.

Reactions to Ration Packaging

Two clear reactions were apparent. As in past discussions many of these soldiers found that a resealable bag – in this case the ziplock meal bag – a useful item for storing a variety of items either for storing trash to be brought out of the field or keeping socks or other items dry and easily accessible. Both the resealable bag and the configuration of the Zapplesauce (pouch with a formed spout) were viewed in a favorable light. These soldiers reiterated what others have stated in that having an easy to use way of consuming liquid or semi liquids is something soldiers want. Many feel that having a pouch to enable easy rehydration and drinking of beverages would encourage better hydration as well as energy intake (see recommendations). Most of these soldiers used camelbacks instead of canteens for their water and a few soldiers pointed out that while great for water they still need something in which to mix beverages.



Figure 7. Innovative CHO Packaging Design.

5 -- RECOMMENDATIONS

Discussion of Future First Strike Ration Development Efforts

Ultimately, today's breakthroughs regarding the HooAH!® Bar, ERGO™ drink, and shelf stable sandwiches are just the preliminary steps in the development of an array of similar items into the development of a nutritionally complete ration using pre-assembled sub-components. Individual combat rations will build upon the successes of today's prototype "first strike ration" concept coupled with the technology of the future to deliver a modular ration system that is tactically responsive for the high-intensity battlefield of today's U.S. Armed Forces. The First Strike Ration (FSR) will provide a high energy, nutritionally optimized, eat out-of-the hand/on-the-move meal with scenario driven tailorability (cold, temperate, hot environment) for use during the first 24-96 hours of combat. Projected weight and volume will be reduced as compared to the MRE with a similar cost per calorie. Micronutrient fortification is anticipated. The developmental program will consist of a two-pronged effort that will first capitalize on the success of the AWE prototype ENRG ration and maximize application of suitable commercial and existing military components to provide an enhanced near-term product with improved and optimized packaging. Secondly, the objective FSR will integrate emerging item and technology developments from a number of initiatives such as Combat Optimized Ration Components, Bio-engineered Smart Foods, Performance Enhancing Delivery Systems, and other innovative technology/item development efforts for an optimally designed and configured product to meet the operational challenges as presented in the new doctrine. Further packaging innovations will be examined as they mature and transition from tech base and integrated in the final configuration as suitable and cost effective in meeting overall objectives. It will be formulated to provide optimal nutrition and acceptance and sustain the performance of combat forces when fed without supplementation of other food sources. Close coordination will be maintained with the OTSG and the CBTDEV activities to ensure the special purpose ration design is operationally and nutritionally sound for the intended scenario. Key characteristics for future First Strike development include:

- Integration of familiar, commercial products/technologies consistent with military operational requirements.
- Application of items of optimum density & nutrition to maintain/ improve physical and mental performance and counteract the effects of combat stress; it may be supplemented with a variety of food components to ensure maximum caloric utilization and maximum nutritive value.
- Acceptable to the consumer throughout the product shelf life.
- Optimal utility, consumable on the move with limited to no preparation, modular, and reduced weight/cube footprint.

- Shelf-stable under all climatic conditions.
- Maximum ease-of-use and be consumable in all environmental/ climatic conditions without heating or thawing.
- Packaging to provide protection against environmental extremes, moisture, insect and rodent infestation, enhance use, logistics handling and distribution.

Future First Strike Rations will be of paramount importance in helping the 21st Century warfighter in the forward area "point of the spear" to maintain peak performance, nutritional status, and mental and physical alertness while operating in the highly technical, highly mobile, digitized battlefields of the future. This type of advanced individual ration is consistent with new doctrine, tactics and vision and the science and technology is available to provide an enhanced targeted platform for today's warriors. This represents a unique and significant opportunity as doctrine, requirements and technology converge to design an optimized individual combat ration product. It will enhance the ability of the warfighter to perform skilled movements with speed, coordination, repetition, and mental and physical awareness with no meal preparation required time and by every measure reducing its logistical footprint. Specific ration selection and application will be predicated on operational mission profile, geographic location and anticipated battlefield scenarios. This stripped ration system will also provide the Services with a lighter weight, less expensive, nutritional adequate, and performance enhancing ration to be utilized during training exercises as a "training ration". The modular design will enable reduced calorie intake as necessary for less demanding operations. The near term 1st generation First Strike Ration will provide an interim capability that will capitalize on mature technologies, in-house development, and technology transitions, as well as compatible commercial products for high acceptability.

Link to Future Corollary Development Efforts within Combat Feeding Program

Corollary development efforts regarding improved/innovative packaging, supplement performance enhancing products, and hydration bags dovetail with development efforts regarding near term and future First Strike Ration concepts that further support implementation of the Army's Vision for the Future, the future Full Spectrum Brigades, and Joint Vision 2020. Refinement and development of these initiatives will close the gap between present DOD Combat Feeding ration platforms and products and the emerging, dynamic Army Vision for the Future and the comprehensive transformation of the Army.

PACKAGING - There is a need to investigate various improvements to combat ration packaging to minimize packaging waste, promote/enhance ease-of-use and acceptance, reduce or eliminate excess, redundant or unnecessary packaging, and reduce footprint, weight, bulk and cost as allowable. A thorough evaluation of packaging and packing design, configuration, materials, features, and performance requirements will provide opportunities to consider commercial and military technologies for integration in advanced prototype designs. New technology and material opportunities may enable either lower cost film construction or enhance protection/reduce vulnerability levels for insect penetration and increase package flexibility and reduce weight investigate improved materials that will potentially result in a more space efficient, cost effective ration products. These initiatives will challenge conventional ration packaging concepts and methods in terms of materials and requirements in order to introduce new technologies and/or reconfigure packaging to achieve weight, cube, soldier load, and mobility mandates without degradation or compromise of critical performance characteristics.

PERFORMANCE ENHANCING SUPPLEMENTS - Efforts to develop or adapt existing commercial or in-house performance enhancing beverage/meal products to Military operations are imperative to enable sustained performance in intense military and combat operations and are of paramount importance in helping the warfighter maintain body weight, nutritional status, and mental and physical alertness while operating under highly strenuous and stressful conditions. Identification and evaluation of commercially available hi-protein, carbohydrate, and carbohydrate/electrolyte products will be conducted for possible integration with military rations. Dry powdered items as well as liquid and gel type products will be considered and studied as part of this effort. Such products may be well suited to various ration platforms including the MRE, and/or future FIRST STRIKE ration for use by military personnel operating in hot weather, high altitudes, and/or highly stressful/strenuous levels of activity lasting greater than three hours.

Under these conditions, mission performance is severely compromised due to loss of essential body fluids/salts caused by carbohydrate and electrolyte deficiency.

DRINK PACK FOR POWDERED RATION COMPONENTS - Beverage powders in military rations cannot be reconstituted in their original packages and must therefore be mixed with water in separate vessels or consumed dry. Army doctrine FM 2110-1 Unit Field Sanitation permits the use of water only in canteens and mandates procedures for proper sanitation of canteen cups after use. Field observations have shown that many soldiers choose not to use the canteen cup for mixing beverages, as it is difficult and time consuming to wash and sanitize before reuse. Beverage powders provided with rations are often discarded. Focus groups on the ENRGI concept and First Strike rations stated that the addition of a rehydration pouch for beverage consumption would unequivocally encourage better hydration and energy intake. Consequently, there is a need to develop a flexible, disposable package designed to allow rapid mixing in the package, and consumption of the rehydrated products directly from the package. This drink pack will be designed to have stand-alone capability, be flexible, reclosable, disposable, and minimally sized to hold the required powder to water ratio. Sizing and configuration of the pack will further examine use with hot and cold beverages, performance enhancing beverage products, instant soup bases, and dehydrated entrées for multiple applications and maximum benefit. The benefits of a functional package to contain and serve beverages and other powdered components are numerous. It will be designed for maximum compatibility and interoperability with commercial products as well as military standard systems for personal water and hydration. The drink pack will promote the consumption of dehydrated products and water, thereby improving the warfighters' nutritional and hydration status.

This document reports research undertaken at the U.S. Army Soldier and Biological Chemical Command, Soldier Systems Center, and has been assigned No. NATICK/TR-0/1 0/2 in a series of reports approved for publication.

THIS PAGE LEFT INTENTIONALLY BLANK.

APPENDIX A
Objective Force Design

APPENDIX A: OBJECTIVE FORCE DESIGN

OBJECTIVE FORCE DESIGN

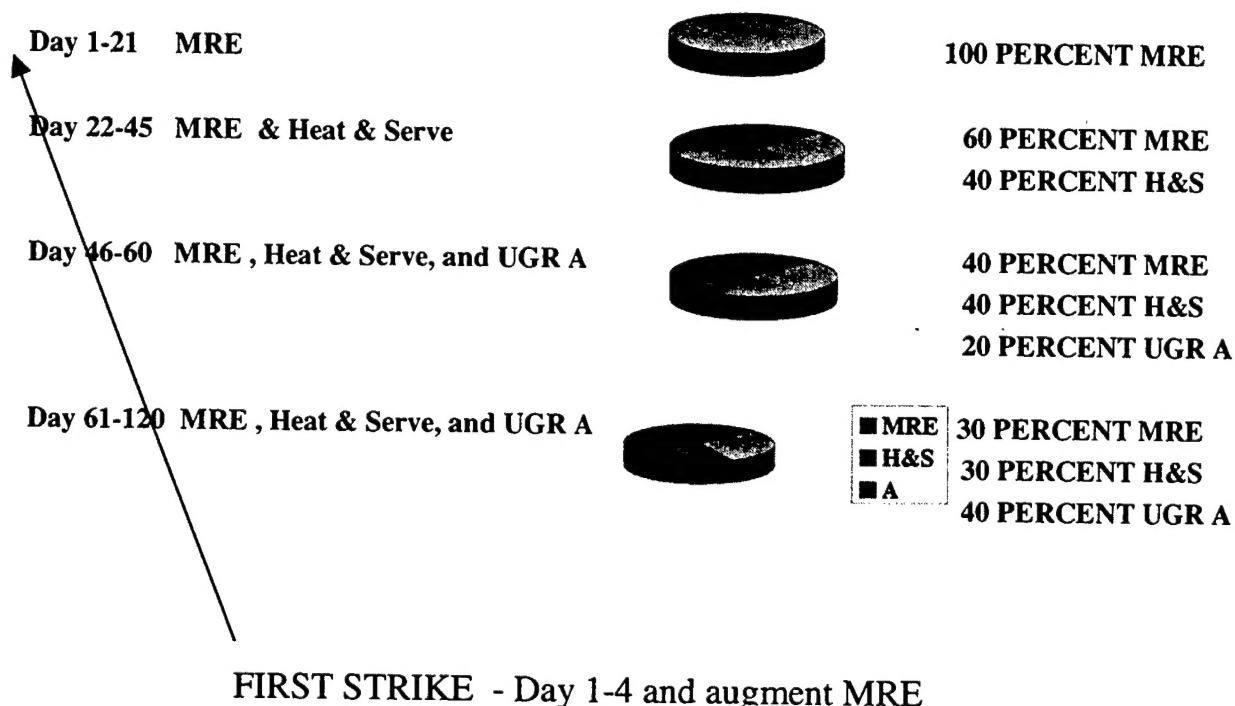
Characteristic	Tactical Response
<i>Responsiveness</i>	<ul style="list-style-type: none"> (1) Ability to put forces where needed on the ground within hours. (2) Force readiness to accomplish its mission regardless of environment, nature or scope of the proposed operation, or other commitments. (3) Capability for preemptive strike, not just reactive. (4) Force response capability from low to high intensity. (5) Mobilization access to the entire force in a timely manner.
<i>Deployability</i>	<ul style="list-style-type: none"> (1) Ability to rapidly deploy, employ and sustain forces, within hours. (2) Speed to strategic deploy forces & avert conflict through deterrence. (3) Standup a combat brigade on the ground within 96 hours, a division within 120 hours, and five divisions within 30 days. (4) Capability to position forces to create advantage in theater and on dispersed battlefields. (5) Forces rapidly deployable in three dimensions across the theater to provide adversaries a more complex targeting challenge.
<i>Agility</i>	<ul style="list-style-type: none"> (1) Ability to immediately shift intensity of operations without augmentation, break in contact, or additional training. (2) Ability to seamlessly transition within or between operations from non-combat disaster relief to low intensity contingencies to high intensity warfighting.
<i>Versatility</i>	<ul style="list-style-type: none"> (1) Future forces more adaptive to both different and changing situations as well as interchangeable for increased utility. (2) Ability to commit all of the force in its turn, regardless of component, to meet the spectrum of operational demands.
<i>Lethality</i>	Overwhelming lethality embedded in every force and unit, including support forces as a means to: prevent loss of life; stop political and operational momentum shift; deter escalation; and use fewer forces to achieve desired effects and reduce logistics footprint.
<i>Survivability</i>	Protect the force and ensure its survival to overcome adaptive asymmetric countermeasures to our forces and emerging threat capabilities through new technologies and systems and elimination of fratricide risk.
<i>Sustainability</i>	<ul style="list-style-type: none"> (1) Capability to continue operations one day longer than any adversary we confront. (2) Use of reach back & split basing to reduce sustainment requirements. (3) Use of host nation/ allied support and exploit advanced technologies to lower logistics footprint and related costs of support structure.

APPENDIX B
PROPOSED REVISED CONCEPT FOR WARTIME FEEDING

WARTIME FEEDING PLAN

✓ Wartime feeding plan is used to determine War Reserve levels and industrial surge requirements

✓ Plan is based on combat activity and arrival of troops and equipment



ACRONYMS

CFP	Combat Feeding Program
CHO	Carbohydrate
CSA	Chief of Staff of the Army
ENRGI	Enhanced Ration, General Issue
ERGO	Energy-Rich, Glucose Optimized
FRH	Flameless Ration Heater
FSR	First Strike Ration
FTX	Field Training Exercise
HooAH!®	Nutritious, Energy Booster Bar
IBCT	Interim Brigade Concept Team
JCF-AWE	Joint Contingency Force - Advanced Warfighting Experiment
JRTC	Joint Readiness Training Center
JSORF	Joint Service Operational Ration Forum
JV2020	Joint Vision (Army Concepts & Doctrine)
LW	Land Warrior
METT-T	Mission, Enemy, Troops, Terrain, and Time
MRE	Meal, Ready-To-Eat
MSR	Military Service Requirement
MTW	Major Theater War
PFC	Private First Class
RSTA	Reconnaissance, Surveillance, and Target Acquisition
SGT	Sergeant
SASO	Stability and Security Operations
SSCO	Small Scale Contingency Operations
WMD	Weapons of Mass Destruction